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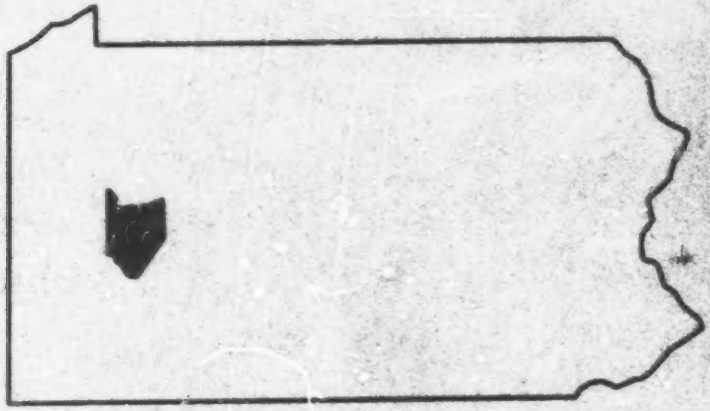
FLOOD INSURANCE STUDY

ORIGINAL

BOROUGH OF FORD CITY, PENNSYLVANIA
ARMSTRONG COUNTY



Am/SI

MAY 19, 1987

Federal Emergency Management Agency

COMMUNITY NUMBER - 420094

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NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program (NFIP) have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study (FIS) may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

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FLOOD INSURANCE STUDY
BOROUGH OF FORD CITY, ARMSTRONG COUNTY, PENNSYLVANIA

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the Borough of Ford City, Armstrong County, Pennsylvania, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates and assist the community in its efforts to promote sound flood plain management. Minimum flood plain management requirements for participation in the National Flood Insurance Program (NFIP) are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the State (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were prepared by Benatec Associates, Inc., for the Federal Emergency Management Agency (FEMA), under Contract No. EMW-84-C-1608. This work was completed in December 1985.

1.3 Coordination

On April 18, 1984, an initial Consultation and Coordination Officer's (CCO) meeting was held with representatives from FEMA, the borough, and Benatec Associates, Inc. (the study contractor), to determine the streams to be studied by detailed methods. The meeting was held to explain the nature and purpose of the study, to outline the scope and limits of the work, and to obtain flood information currently available concerning the community.

On June 20, 1986, a final CCO meeting was held with representatives from FEMA, the borough, and the study contractor to review the results of the study.

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2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the Borough of Ford City, Armstrong County, Pennsylvania. The area of study is shown on the Vicinity Map (Figure 1).

The Allegheny River and Fort Run were studied in detail for their entire length within the corporate limits. An area located on the eastern side of CONRAIL was also studied by detailed methods; this is an area of 100-year flooding where average depths are less than 1 foot and is designated as Zone X. The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development and proposed construction through December 1990.

2.2 Community Description

Ford City is completely surrounded by the Township of Manor and is located in west-central Armstrong County. It had a population of 3,923 according to the 1980 census, a decrease of 826 from the 1970 census (Reference 1).

Manufacturing comprises the largest percentage of the civilian work force, followed by retail/wholesale and service-oriented occupations. The Ford City Glass Factory, built on the floodplain, went into operation in 1887 and was the largest plant of its kind in the world at one time. There is also a wastewater treatment facility located in Ford City.

The climate of this area is humid continental with average temperatures ranging from 48 to 50 degrees Fahrenheit (°F). Annual precipitation is between 40 to 44 inches. Summers are pleasant and warm with thunder-showers occurring on the average of 22 days between June and August. Fall is the driest time of the year with dry periods rarely exceeding 2 or 3 weeks. Winter snow cover is 1 inch or more approximately 50 days each year.

The topography has rolling hills with elevations ranging from 900 to 1,200 feet above mean sea level. The soils in the Ford City area are of the Rainsboro-Melvin-Steff association. On terraces and floodplains the soils are moderately-well to poorly drained, deep, and nearly level to gently sloping (Reference 2).

2.3 Principal Flood Problems

Records on the Allegheny River in the vicinity of Ford City indicate that major flooding occurs at various times of the year. However, the main

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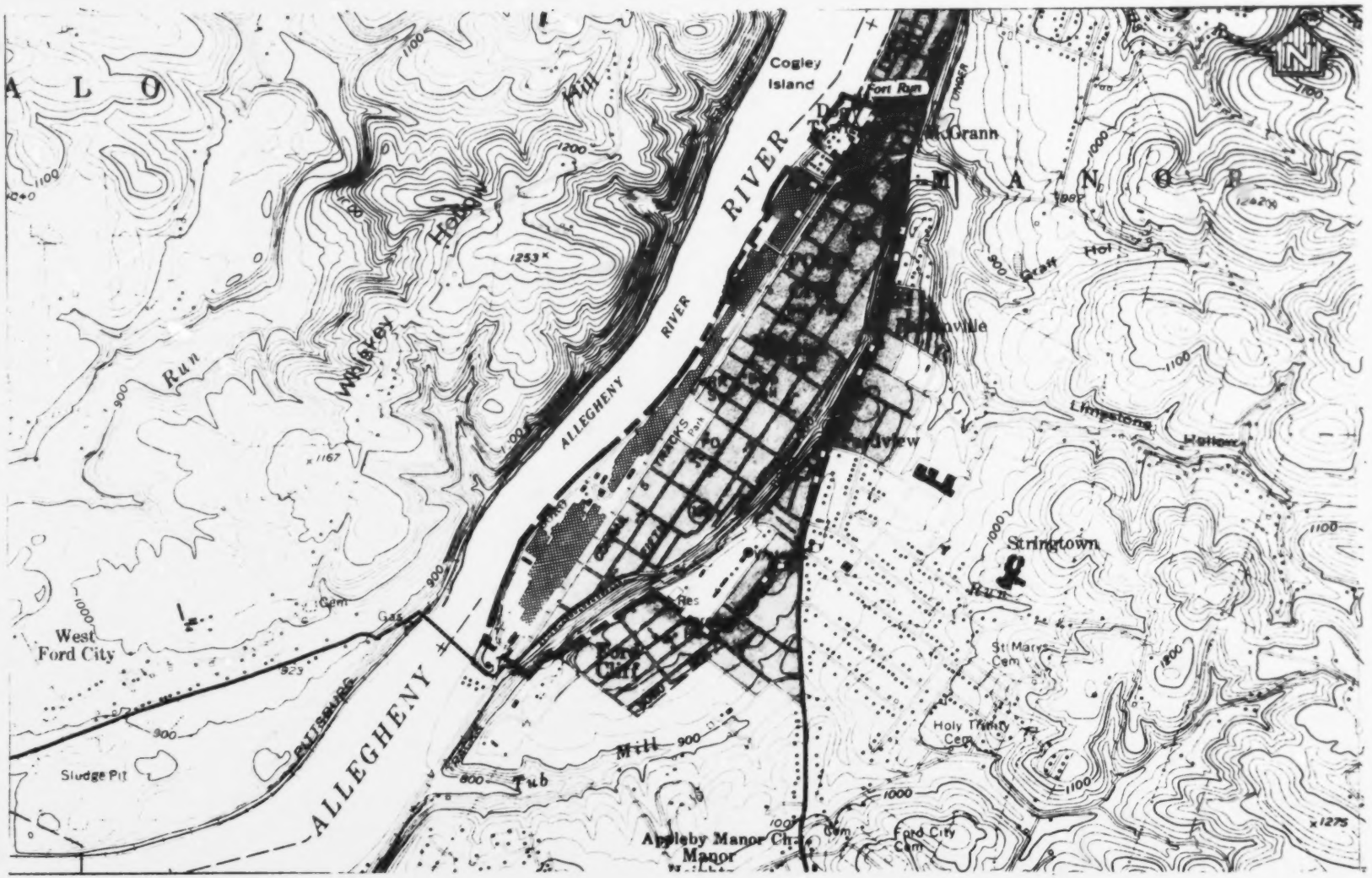

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOROUGH OF FORD CITY, PA

(ARMSTRONG CO.)

APPROXIMATE SCALE

2000 0 2000 4000 8000 FEET

VICINITY MAP

FIGURE 1

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flood season is typically December through April and is usually the result of heavy spring rains and snow melt. Floods occurring during the summer are rare and are sometimes associated with tropical storms.

The maximum flood of record in Armstrong County, downstream of Kittanning, occurred in March of 1913 and delivered a discharge of approximately 269,000 cubic feet per second (cfs). The estimated 100-year discharge for the Allegheny River at Ford City is 215,500 cfs.

Low-lying areas of Ford City are subject to periodic flooding caused by heavy localized rains. During a 100-year flood, flooding was limited to the depressed areas around storm drainage inlets and other minor street flooding. This flooding is primarily caused by heavy rainstorms that cannot be adequately handled by the pumping facility; however, this does not present a significant problem to the community.

At the time of study, there were no known high-water marks or principal flood problems for the portion of Fort Run.

2.4 Flood Protection Measures

There are several dams and reservoirs that exist within the Allegheny River basin that act to reduce flood levels on the Allegheny River within Armstrong County. These structures were built and are operated by the U. S. Army Corps of Engineers (COE) to reduce major flood crests for several downstream communities.

Ford City is protected from riverine flooding by a wide area of fill placed in an industrial park on the western side of the railroad. The industrial park area is, for the most part, at or above the 100-year flood elevation. Those areas that are below the 100-year flood level are not affected by floodwaters from the Allegheny River. These areas consist of internal drain sumps and loading docks, with the lowest point approximately 3 feet lower than the river's 100-year flood level. These low spots are also protected by a series of gates and pumps that are owned, operated, and maintained by the local industries. These pumps and gates affect only their owners.

The majority of the borough, which lies to the east of CONRAIL, is much lower than the elevation of the industrial park. The lowest point is approximately 9 feet lower than the 100-year flood level of the Allegheny River. This portion of the borough is protected by a series of flood gates and pumping stations that are owned, operated, and maintained by borough officials for the primary purpose of controlling storm water.

There are no other existing or proposed flood protection projects for the borough at the time of this study.

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3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for flood plain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for each flooding source studied in detail affecting the community.

The data for these analyses for the streams studied by detailed methods were based on records of river stages and discharges from gage stations located on the Allegheny River. Records of the Natrona gage station (No. 03049500), located 520 feet upstream from a dam at lock No. 4 in Allegheny County, have been maintained from October 1938 to date by the USGS. Records of the Kittanning gage station (No. 03036500), located 5.7 miles upstream from Crooked Creek in Armstrong County, have been maintained by the USGS from August 1904 to 1928 and October 1934 to date (Reference 3).

Peak discharges for the Allegheny River within the corporate limits of Ford City were calculated using a log-Pearson analysis to develop discharge-frequency curves for the Allegheny River Basin (Reference 4).

Peak discharges for Fort Run within the corporate limits of Ford City were calculated using the COE multiple regression formula developed for streams in the Ohio River Basin (Reference 5).

A summary of drainage area-peak discharge relationships for the streams studied in detail are shown in Table 1, "Summary of Discharges."

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TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
ALLEGHENY RIVER					
At upstream corporate limits	8,973.00	152,000	196,000	215,000	261,000
FORT RUN					
At confluence with Allegheny River	1.90	425	870	1,145	1,935

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Cross sections for the backwater analyses of the streams studied in Ford City were obtained from aerial photographs at a scale of 1:12,000 and topographic maps at a scale of 1:4,800 with a contour interval of 4 feet (References 6 and 7). The below-water sections were obtained by field measurement. All bridges, dams, and culverts were field surveyed to obtain elevation data and structural geometry.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 4.2), selected cross-section locations are also shown on the Flood Insurance Rate Map (Exhibit 2).

Water-surface elevations of floods of the selected recurrence intervals were computed using the COE HEC-2 step-backwater computer program (Reference 8). Flood profiles were drawn showing computed water-surface elevations for floods of the selected recurrence intervals. Starting water-surface elevations for the Allegheny River and Fort Run were calculated using the slope/area method.

Channel and overbank roughness factors (Manning's "n") values used in the hydraulic computations were chosen by engineering judgment and based on field observations of the streams and flood plain areas (Reference 9). The channel "n" values for the Allegheny River ranged from 0.028 to 0.033, and the overbank "n" values ranged from 0.040 to 0.050. The channel "n" value for Fort Run was 0.065 and the overbank "n" value was 0.120.

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An internal flooding analysis was conducted for the portion of Ford City located on the eastern side of CONRAIL. The 100- and 500-year discharges were routed through the pumping stations to determine the amount of storm water that would ultimately pond within the borough. The study took into consideration factors such as system storage, pumping capacities, and the topography of the area. The study did not consider any flow being contributed by the Allegheny River.

The results of this analysis indicated that there will be no significant flooding in Ford City east of the railroad tracks, but rather several pockets of shallow flooding. The flooding areas will consist mainly of the depressed areas around storm drainage inlets. These depressed areas have limited storage capacity, and when they become filled, the excess water will flow in the form of sheet flow toward the south end of the borough. Most flooding areas will be contained within the borough streets.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in this study are shown on the maps; the descriptions of the marks are presented in Elevation Reference Marks (Exhibit 3).

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study provides 100-year flood elevations and delineations of the 100- and 500-year flood plain boundaries and 100-year floodway to assist communities in developing flood plain management measures.

4.1 Flood Plain Boundaries

To provide a national standard without regional discrimination, the 1 percent annual chance (100-year) flood has been adopted by FEMA as the base flood for flood plain management purposes. The 0.2 percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For the flooding sources studied in detail, the 100- and 500-year flood plain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:24,000 with a contour interval of 20 feet (Reference 10).

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The 100- and 500-year flood plain boundaries are shown on the Flood Insurance Rate Map (Exhibit 2). On this map, the 100-year flood plain boundary corresponds to the boundary of the areas of special flood hazards (Zones A and AE), and the 500-year flood plain boundary corresponds to the boundary of areas of moderate flood hazards. In cases where the 100- and 500-year flood plain boundaries are close together, only the 100-year flood plain boundary has been shown. Small areas within the flood plain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

4.2 Floodways

Encroachment on flood plains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood plain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent flood plain areas, that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

The floodways presented in this study were computed for certain stream segments on the basis of equal conveyance reduction from each side of the flood plain. Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. The results of the floodway computations are tabulated for selected cross sections (Table 2). The computed floodways are shown on the Flood Insurance Rate Map (Exhibit 2). In cases where the floodway and 100-year flood plain boundaries are either close together or collinear, only the floodway boundary is shown. Portions of the floodway widths for the Allegheny River extend beyond the corporate limits.

The area between the floodway and 100-year flood plain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 2.

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FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Allegheny River								
A	870[1]	706[3]	22,858	9.4	787.6	787.6	787.8	0.2
B	1,620[1]	717[3]	22,170	9.7	787.8	787.8	788.0	0.2
C	2,820[1]	689[3]	22,941	9.4	788.3	788.3	788.5	0.2
D	3,990[1]	833[3]	24,765	8.7	788.9	788.9	789.1	0.2
E	5,590[1]	826[3]	26,604	8.1	789.5	789.5	789.7	0.2
F	8,740[1]	1,270[3]	29,880	7.2	790.6	790.6	790.8	0.2
Fort Run								
A	160[2]	26	156	7.3	790.6	777.9[4]	778.8	0.9

[1]Feet above corporate limits (extended)
[2]Feet above confluence with Allegheny River
[3]This width extends beyond corporate limits
[4]Elevation computed without consideration of backwater from Allegheny River

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY
BOROUGH OF FORD CITY, PA
(ARMSTRONG CO.)

FLOODWAY DATA

ALLEGHENY RIVER - FORT RUN

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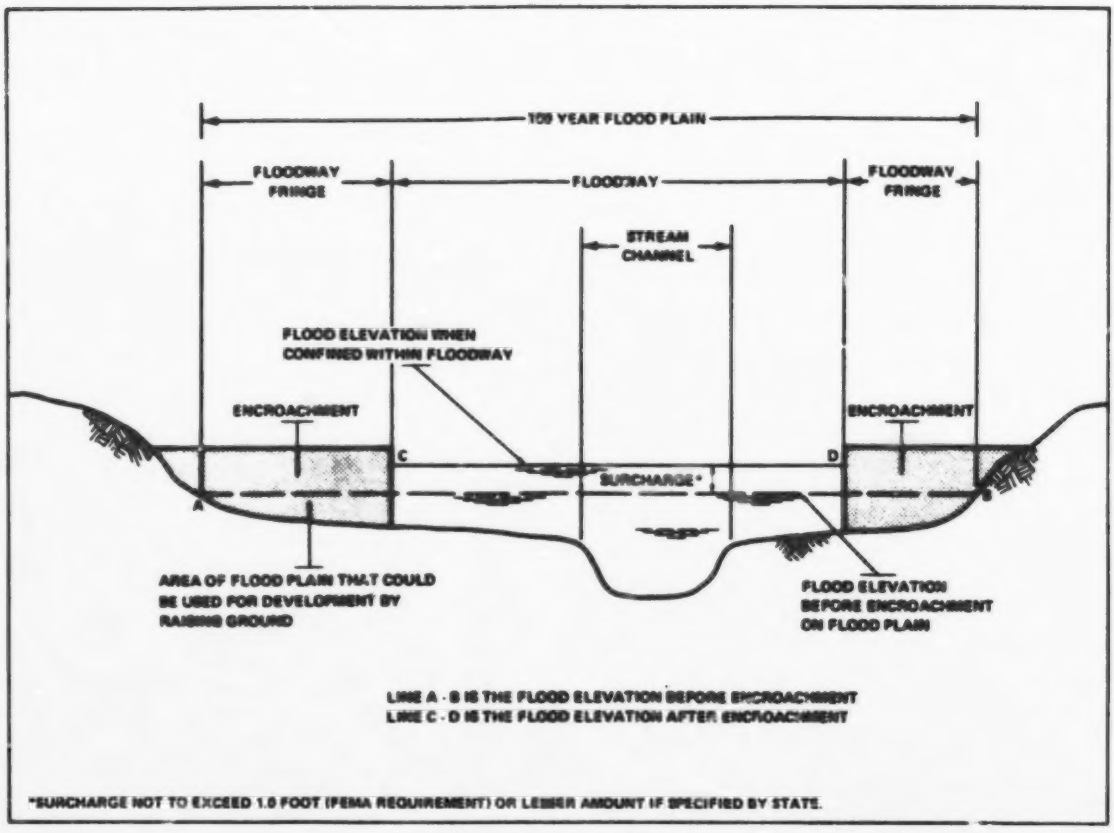
100 YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE A - B IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE C - D IS THE FLOOD ELEVATION AFTER ENCROACHMENT
*SURCHARGE NOT TO EXCEED 1.0 FOOT (FEMA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE.

FLOODWAY SCHEMATIC Figure 2

Near the mouths of streams studied in detail, floodway computations are made without regard to flood elevations on the receiving water body. Therefore, "Without Floodway" elevations presented in Table 2 for certain downstream cross sections of Fort Run are lower than the regulatory flood elevations in that area, which must take into account the 100-year flooding due to backwater from other sources.

5.0 INSURANCE APPLICATION

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. These zones are as follows:

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Zone A

Zone A is the flood insurance rate zone that corresponds to the 100-year flood plains that are determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base flood elevations or depths are shown within this zone.

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 100-year flood plains that are determined in the Flood Insurance Study by detailed methods. In most instances, whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AH

Zone AH is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually areas of ponding) where average depths are between 1 and 3 feet. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AO

Zone AO is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Average whole-foot depths derived from the detailed hydraulic analyses are shown within this zone.

Zone A99

Zone A99 is the flood insurance rate zone that corresponds to areas of the 100-year flood plain that will be protected by a Federal flood protection system where construction has reached specified statutory milestones. No base flood elevations or depths are shown within this zone.

Zone V

Zone V is the flood insurance rate zone that corresponds to the 100-year coastal flood plains that have additional hazards associated with storm waves. Because approximate hydraulic analyses are performed for such areas, no base flood elevations are shown within this zone.

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Zone VE

Zone VE is the flood insurance rate zone that corresponds to the 100-year coastal flood plains that have additional hazards associated with storm waves. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 500-year flood plain, areas within the 500-year flood plain, and to areas of 100-year flooding where average depths are less than 1 foot, areas of 100-year flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 100-year flood by levees. No base flood elevations or depths are shown within this zone.

Zone D

Zone D is the flood insurance rate zone that corresponds to unstudied areas where flood hazards are undetermined, but possible.

6.0 FLOOD INSURANCE RATE MAP

The Flood Insurance Rate Map is designed for flood insurance and flood plain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 100-year flood plains that were studied by detailed methods, shows selected whole-foot base flood elevations or average depths. Insurance agents use the zones and base flood elevations in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For flood plain management applications, the map shows by tints, screens, and symbols, the 100- and 500-year flood plains. Floodways and the locations of selected cross sections used in the hydraulic analyses and floodway computations are shown where applicable.

7.0 OTHER STUDIES

In December 1973, the COE published the Flood Plain Information report for Armstrong County, Pennsylvania (Reference 11). The report covers the Allegheny River from the Township of Parker to the Borough of Freeport and includes both the 100- and 500-year floods. The results of this study are in agreement with the calculations of the COE study.

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A Flood Insurance Study for the Township of Manor is currently being prepared (Reference 12). The results of that study will be in agreement with the results of this study.

8.0 LOCATION OF DATA

Information concerning the pertinent data used in preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, FEMA, Liberty Square Building (Second Floor), 105 South Seventh Street, Philadelphia, Pennsylvania 19106.

9.0 BIBLIOGRAPHY AND REFERENCES

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EXHIBIT 3 - ELEVATION REFERENCE MARKS

Reference Mark	Elevation (Feet NGVD)	Description of Location
RM 1	789.53	Top of fire hydrant on east side of Third Avenue approximately 200 feet northeast from intersection of Sixth Street and Third Avenue.
RM 2	793.24	Top of fire hydrant approximately 175 feet west from intersection of Sixteenth Street and Third Avenue.

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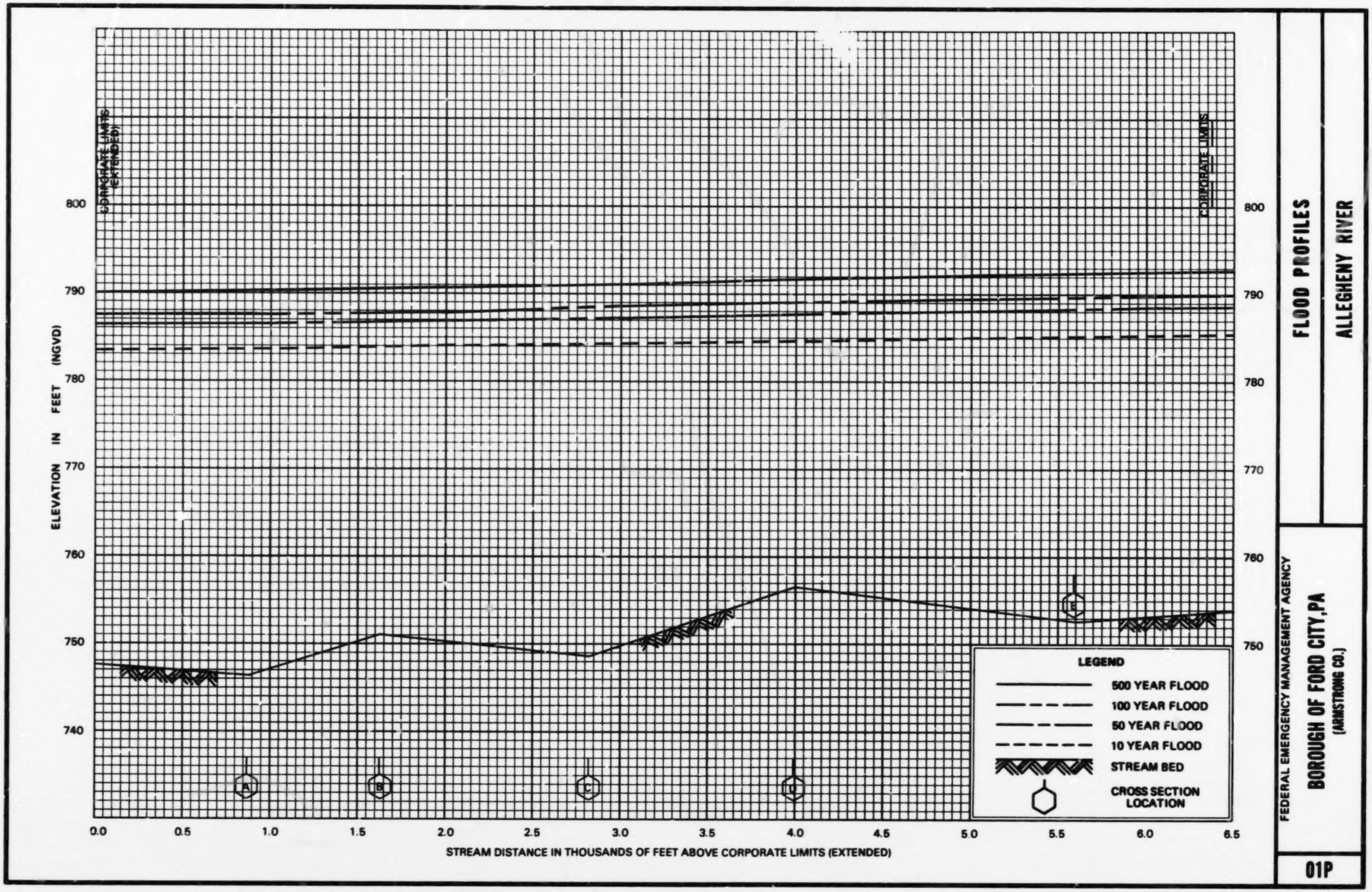

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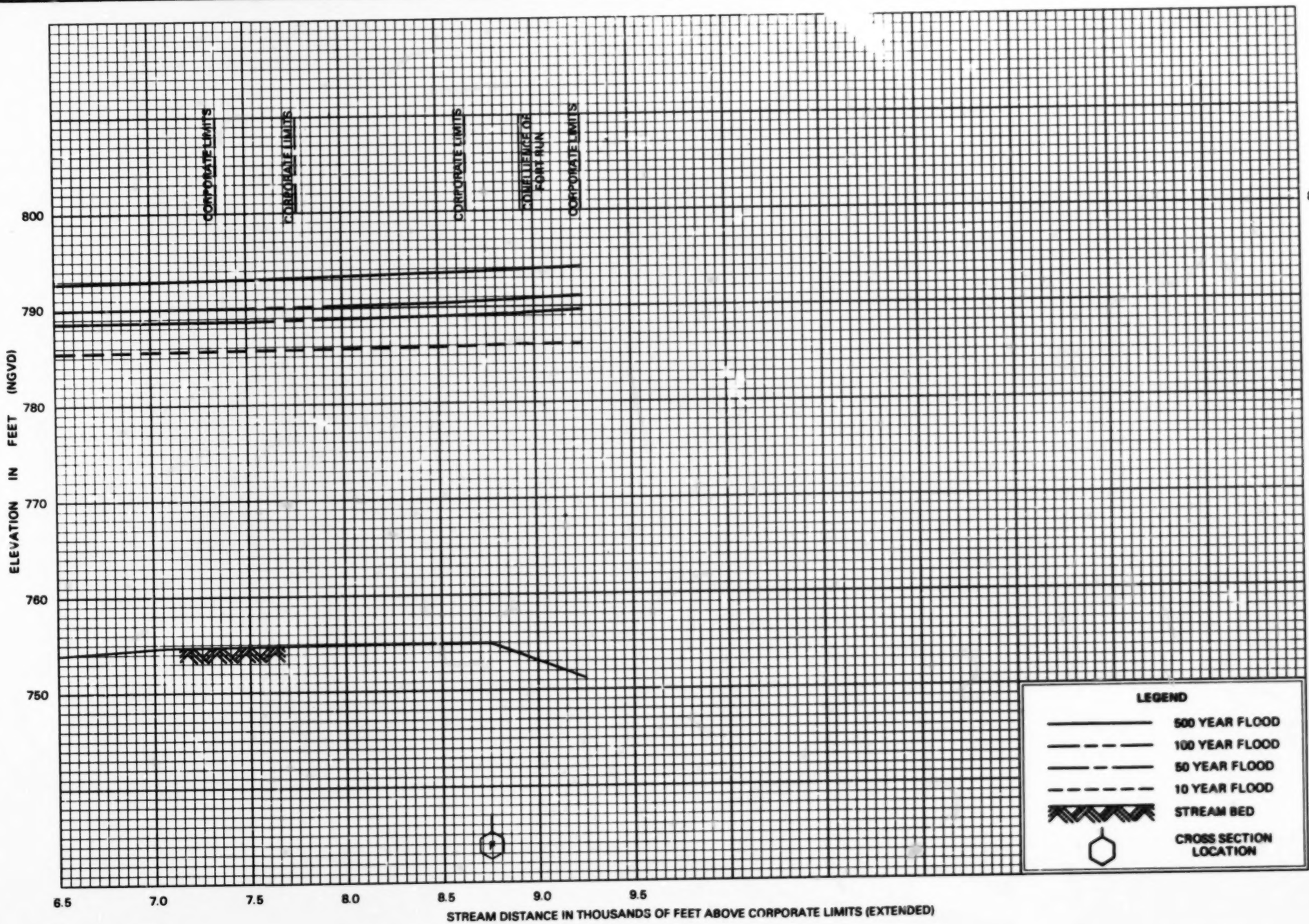

FLOOD PROFILES

ALLEGHENY RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOROUGH OF FORD CITY, PA

(ARMSTRONG CO.)

02P

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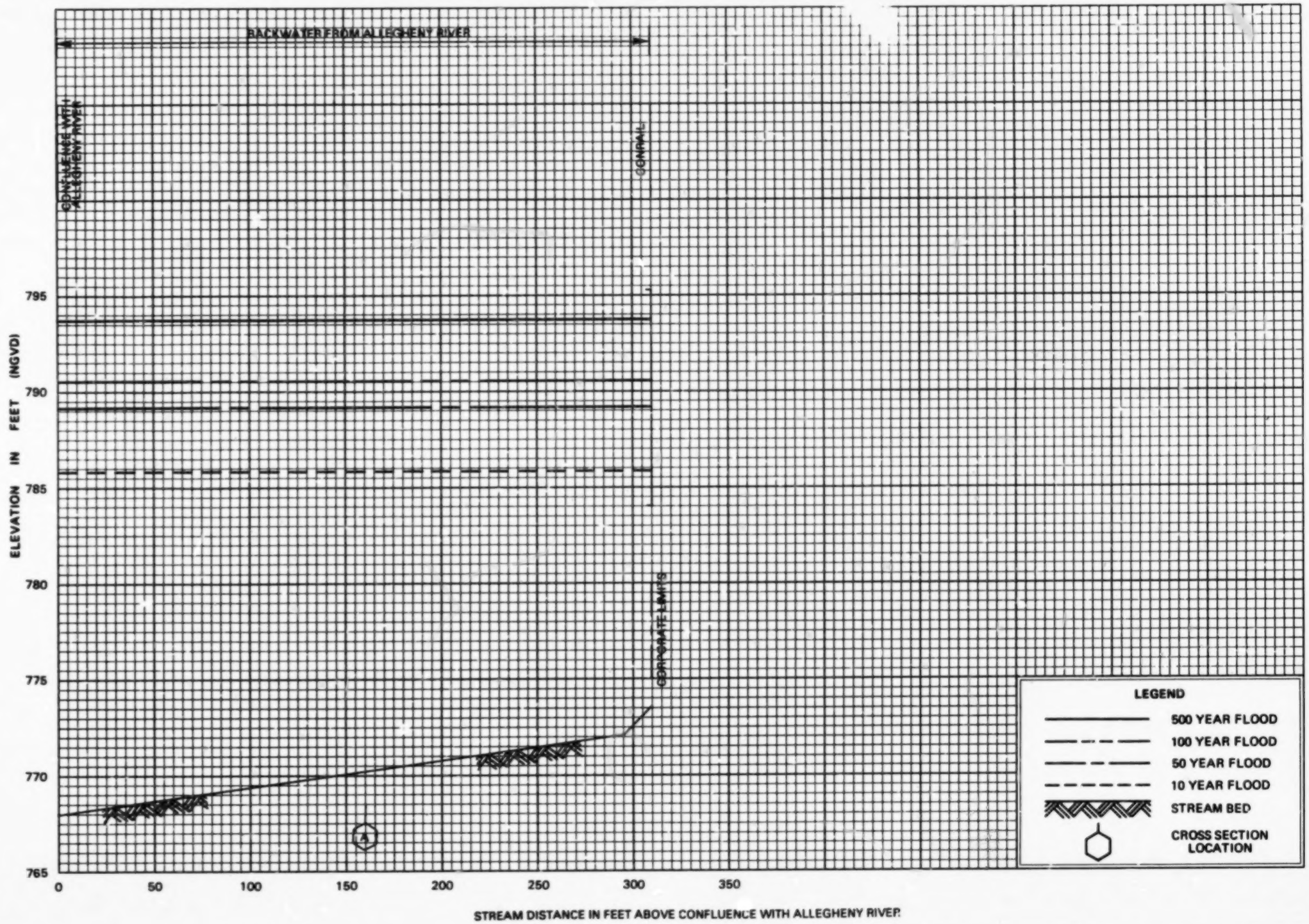

FLOOD PROFILES

FORT RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOROUGH OF FORD CITY, PA

(ARMSTRONG CO.)

03P

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